

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Perceived anxiety and physical activity behaviour changes during the early stages of COVID-19 restrictions in community dwelling adults in Canada: a cross-sectional study
AUTHORS	McCormack, Gavin; Doyle-Baker, Patricia; Petersen, Jennie; Ghoneim, Dalia

VERSION 1 – REVIEW

REVIEWER	Oppert Jean-Michel University Pierre et Marie Curie, Institute of cardiometabolism and nutrition (ICAN), Pitie-Salpêtrière hospital (AP-HP)
REVIEW RETURNED	04-Apr-2021

GENERAL COMMENTS	<p>General comments</p> <p>In this paper, authors aimed to describe physical activity and sedentary behaviour patterns among Canadian adults in relation to restrictions imposed by the COVID-19 pandemic and to assess their relations with anxiety related to COVID-19. A main finding is that perceived changes in physical activity differed by level of anxiety related to COVID-19, although actual levels of physical activity and sedentary behaviour did not. The paper is very well written and easy to follow. Methods are sound and conclusions derive from the findings. The topic addressed is of importance given the planetary dissemination of the COVID-19 and the duration of this crisis which is still ongoing. There are some concerns that would need to be addressed.</p> <p>Authors should acknowledge they assessed anxiety only in relation to COVID-19. Pre-existing anxiety or psychopathology (eg. depression) might be important for anxiety levels and health-behaviours in the times of COVID-19. Along the same lines, authors apparently did not assess health status in their subjects. Overall perceived health (and even more so detailed health status) may impact on anxiety and physical activity behaviours. Also, regarding implications, one can hypothesize that not only measures related to physical activity and sedentary behaviour could be beneficial, but also interventions taking into account anxiety associated to the pandemic.</p> <p>Specific comments</p> <ul style="list-style-type: none">-Methods, page 6, line 28: did the public health measures imposed in the province of Alberta include specific indications about physical activity and sports? As mentioned later in the Discussion (page 10, line 49)-Methods, page 7, line 8: the reference for the IPAQ is usually Craig et al. MSSE 2003-Discussion, page 11, line 46: among limitations, authors could mention i) the assessment of anxiety related to COVID-19 by only
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	<p>one question and answers merged into a binary outcome variable; ii) the use of IPAQ questions, IPAQ short form being notoriously subject to over-reporting bias.</p> <p>-Conclusions, page 12: could it be that lessons learnt during the pandemic (eg. findings from this report) could be of use for the promotion of physical activity for health on the long-term (ie when life will return to more "normal" conditions)?</p>
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REVIEWER	Roger C. M. Ho Natl Univ Singapore, Psychological Medicine
REVIEW RETURNED	22-May-2021

GENERAL COMMENTS	<p>I have the following comments for the authors to address. I am happy to review this paper again.</p> <p>1) Under the Introduction, the authors stated "The stress of rapidly adapting to new work, leisure, child-minding, school schedules, and personal economic pressures have likely contributed to increased anxiety during the pandemic". 7-10 Reference 7-10 are not quantitative research. Furthermore, anxiety is more related to lockdown, social distancing and may be facemask use. Please discuss the findings of the following research:</p> <p>Anxiety and Lockdown: Anxiety and Depression Among People Under the Nationwide Partial Lockdown in Vietnam. Front Public Health. 2020;8:589359. Published 2020 Oct 29. doi:10.3389/fpubh.2020.589359</p> <p>Anxiety and social distancing: Impact of COVID-19 on Economic Well-Being and Quality of Life of the Vietnamese During the National Social Distancing. Front Psychol. 2020 Sep 11;11:565153. doi: 10.3389/fpsyg.2020.565153. PMID: 33041928; PMCID: PMC7518066.</p> <p>Facemask use: The Association Between Physical and Mental Health and Face Mask Use During the COVID-19 Pandemic: A Comparison of Two Countries With Different Views and Practices. Front Psychiatry. 2020;11:569981. Published 2020 Sep 9. doi:10.3389/fpsyg.2020.569981</p> <p>2) The authors stated "The rapid transmission, high mortality rate, and perceived risk of infection from COVID-19 could also contribute to anxiety levels 11, 12". Reference 11 focused on Poland and reference 12 is not a research study, just an editorial. The authors should refer to in-depth multinational study and discuss why people in the world face anxious. Please refer to the following studies:</p> <p>Anxiety in Asia- Europe-America study: A chain mediation model on COVID-19 symptoms and mental health outcomes in Americans, Asians and Europeans. Sci Rep 11, 6481 (2021). https://doi.org/10.1038/s41598-021-85943-7</p> <p>Anxiety in middle income countries: The impact of COVID-19 pandemic on physical and mental health of Asians: A study of seven middle-income countries in Asia. PLoS One. 2021 Feb 11;16(2):e0246824. doi: 10.1371/journal.pone.0246824. PMID: 33571297.</p> <p>3) Under the Introduction, the authors mentioned that there was</p>
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	<p>reduction in physical exercise. Stay home order also reduced exposure to greenery. Please refer to the following study:</p> <p>Effects of COVID-19-related stay-at-home order on neuropsychophysiological response to urban spaces: Beneficial role of exposure to nature? Journal of Environmental Psychology 2021, 75, 101590</p> <p>4) Under the discussion, the authors found that "having children, have been associated with higher anxiety during COVID-19." Please compare with other study that found having grown up children was significantly associated with lower levels of anxiety (Tee et al 2020).</p> <p>Tee ML et al Psychological impact of COVID-19 pandemic in the Philippines. J Affect Disord. 2020 Dec 1;277:379-391. doi: 10.1016/j.jad.2020.08.043. Epub 2020 Aug 24. PMID: 32861839; PMCID: PMC7444468.</p> <p>5) The authors stated "Unlike other studies⁴⁶, we did not find higher anxiety among older adults which might reflect our potentially healthier sample" The following study found that students and young people were more anxious than older adults. Please discuss their findings:</p> <p>Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. Int J Environ Res Public Health. 2020 Mar 6;17(5):1729. doi: 10.3390/ijerph17051729. PMID: 32155789; PMCID: PMC7084952.</p> <p>6) The authors should discuss how to increase exercise level. One approach is cognitive behavior therapy. The behavior therapy can increase the exercise level. Please discuss the following:</p> <p>Use of Cognitive Behavior Therapy (CBT) to treat psychiatric symptoms during COVID-19 based on the following reference: Mental Health Strategies to Combat the Psychological Impact of COVID-19 Beyond Paranoia and Panic. Ann Acad Med Singapore. 2020;49(3):155-160</p> <p>7) One limitation is the cross-sectional nature of this study. Please refer to the following longitudinal study and comment on the change of stay home time and this will indicate the impact on physical exercise:</p> <p>A Longitudinal Study on the Mental Health of General Population during the COVID-19 Epidemic in China [published online ahead of print, 2020 Apr 13]. Brain Behav Immun. 2020; S0889-1591(20)30511-0. doi:10.1016/j.bbi.2020.04.028</p>
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VERSION 1 – AUTHOR RESPONSE

Reviewer: 1 (Dr. Jean-Michel Oppert, University Pierre et Marie Curie)

1. In this paper, authors aimed to describe physical activity and sedentary behaviour patterns among Canadian adults in relation to restrictions imposed by the COVID-19 pandemic and to assess their relations with anxiety related to COVID-19. A main finding is that perceived changes in physical activity differed by level of anxiety related to COVID-19, although actual levels of physical activity and sedentary behaviour did not. The paper is very well written and easy to follow. Methods are sound

and conclusions derive from the findings. The topic addressed is of importance given the planetary dissemination of the COVID-19 and the duration of this crisis which is still ongoing. There are some concerns that would need to be addressed.

We appreciate the reviewer's positive comments regarding the value and scientific merit of our manuscript.

2. Authors should acknowledge they assessed anxiety only in relation to COVID-19. Pre-existing anxiety or psychopathology (eg. depression) might be important for anxiety levels and health-behaviours in the times of COVID-19. Along the same lines, authors apparently did not assess health status in their subjects. Overall perceived health (and even more so detailed health status) may impact on anxiety and physical activity behaviours. Also, regarding implications, one can hypothesize that not only measures related to physical activity and sedentary behaviour could be beneficial, but also interventions taking into account anxiety associated to the pandemic.

The reviewer raises an excellent point. We agree that pre-existing psychological and physical health conditions could have influenced levels of COVID-19 related anxiety experienced during the pandemic. We do not have access to pre-pandemic data in our sample and cannot address this in our manuscript however, we now mention this as a limitation (page 11 paragraph 2): "Given the lack of available pre-pandemic data for our sample, we are unable to rule-out the potential effects of pre-existing anxiety, psychopathologies, or health conditions on levels of COVID-19 related anxiety during the early stages of the pandemic."

We agree that interventions that address anxiety during the pandemic are needed, in addition to promoting physical activity. We have added the following sentence to the Conclusions section (page 11, paragraph 3): "In addition to promoting physical activity and discouraging sedentary behaviour, interventions that directly address the increased anxiety associated with infectious disease pandemics are also needed."

3. Methods, page 6, line 28: did the public health measures imposed in the province of Alberta include specific indications about physical activity and sports? As mentioned later in the Discussion (page 10, line 49)

We have now included more detail about the public health measures imposed during this initial stage of the pandemic (page 5, paragraph 3): "The public health measures prohibited attendance at public recreational facilities and private entertainment facilities (e.g., gyms, swimming pools, arenas, community centres, playgrounds, skateboard parks but not golf courses and outdoor shooting ranges). The public health measures also prohibited indoor and outdoor private or public gatherings of more than 15 people (minimum of 2 meters apart) but allowed members of the same household to gather in indoor and outdoor locations."

4. Methods, page 7, line 8: the reference for the IPAQ is usually Craig et al. MSSE 2003

We now cite the Craig et al., 2003 reference mentioned by the reviewer.

5. Discussion, page 11, line 46: among limitations, authors could mention i) the assessment of anxiety related to COVID-19 by only one question and answers merged into a binary outcome variable; ii) the use of IPAQ questions, IPAQ short form being notoriously subject to over-reporting bias.

In response we have added the following to the limitations section of the manuscript (page 11, paragraph 2: "The self-report measures of physical activity and anxiety included in our study may be subject to social desirability and reporting bias. Our survey included a single-item (global) measure of COVID-19 related anxiety however, this may not have fully captured the anxiety experienced during the pandemic and in particular, anxiety experienced in relation to specific life events (e.g., job loss, illness or death of a family member or friend, and isolation from family and friends)."

6. *Conclusions, page 12: could it be that lessons learnt during the pandemic (eg. findings from this report) could be of use for the promotion of physical activity for health on the long-term (ie when life will return to more "normal" conditions)?*

The findings of our study and those elsewhere have highlighted the importance of encouraging physical activity to promote health and wellbeing (whether it be during a pandemic or not). In response to the reviewer, we have added the following sentence to the Conclusions (page 11, paragraph 3: "The pandemic has further highlighted the importance of encouraging physical activity and discouraging sedentary behaviour in general as a means of promoting health and wellbeing in the community."

Reviewer: 2 (Dr. Roger C. M. Ho, Natl Univ Singapore)

1, *Under the Introduction, the authors stated "The stress of rapidly adapting to new work, leisure, child-minding, school schedules, and personal economic pressures have likely contributed to increased anxiety during the pandemic". 7-10 Reference 7-10 are not quantitative research.*

We have removed "increased" from this sentence to better reflect the information provided in the sources cited.

2. *Furthermore, anxiety is more related to lockdown, social distancing and may be facemask use.*

Please discuss the findings of the following research:

a. *Anxiety and Lockdown: Anxiety and Depression Among People Under the Nationwide Partial Lockdown in Vietnam. Front Public Health. 2020;8:589359. Published 2020 Oct 29. doi:10.3389/fpubh.2020.589359*

b. *Anxiety and social distancing: Impact of COVID-19 on Economic Well-Being and Quality of Life of the Vietnamese During the National Social Distancing. Front Psychol. 2020 Sep 11;11:565153. doi: 10.3389/fpsyg.2020.565153. PMID: 33041928; PMCID: PMC7518066.*

c. *Facemask use: The Association Between Physical and Mental Health and Face Mask Use During the COVID-19 Pandemic: A Comparison of Two Countries With Different Views and Practices. Front Psychiatry. 2020;11:569981. Published 2020 Sep 9. doi:10.3389/fpsyt.2020.569981*

We thank the reviewer for providing the above listed references. We now cite reference "c" above and have cited another source, not listed above (Benke C, Autenrieth LK, Asselmann E, Pane-Farre CA. Lockdown, quarantine measures, and social distancing: Associations with

depression, anxiety and distress at the beginning of the COVID-19 pandemic among adults from Germany. *Psychiatry Res.* 2020;293:113462) which demonstrate potential impacts of social distancing, lockdowns, and masking on anxiety. We have also revised the following sentence (page 4, paragraph 2): "The rapid transmission, high mortality rate, and perceived risk of infection from COVID-19 in addition to social distancing, lockdowns, and masking requirements have contributed to anxiety levels."^{11-14"}

3. The authors stated "The rapid transmission, high mortality rate, and perceived risk of infection from COVID-19 could also contribute to anxiety levels 11, 12". Reference 11 focused on Poland and reference 12 is not a research study, just an editorial. The authors should refer to in-depth multinational study and discuss why people in the world face anxious. Please refer to the following studies:

a. Anxiety in Asia- Europe-America study:

A chain mediation model on COVID-19 symptoms and mental health outcomes in Americans, Asians and Europeans. *Sci Rep* 11, 6481 (2021). <https://doi.org/10.1038/s41598-021-85943-7>

b. Anxiety in middle income countries:

The impact of COVID-19 pandemic on physical and mental health of Asians: A study of seven middle-income countries in Asia. *PLoS One.* 2021 Feb 11;16(2):e0246824. doi: 10.1371/journal.pone.0246824. PMID: 33571297.

We appreciate the reviewer's thorough check of our references. At the time of drafting the manuscript little evidence existed on the risk factors for anxiety during the pandemic which explains why we cited an editorial. We no longer cite the editorial and now cite reference "b" from the list above along with a new sentence (page 4, paragraph 2): "A study of seven middle-income Asian countries found being of younger age, not in a relationship, being in contact with people with COVID-19 and worries about COVID-19 were risk factors of adverse mental health, while being male, having children, staying with 6 or more people, employment, higher perceived likelihood of surviving COVID-19, less exposure to health information, hand hygiene practices and mask wearing were protective factors against adverse mental health."^{15"}

4. Under the Introduction, the authors mentioned that there was reduction in physical exercise. Stay home order also reduced exposure to greenery. Please refer to the following study: Effects of COVID-19-related stay-at-home order on neuropsychophysiological response to urban spaces: Beneficial role of exposure to nature? *Journal of Environmental Psychology* 2021, 75, 101590

We appreciate the reviewer bringing this study to our attention. However, we feel that this study does not fit within the scope of our manuscript. The study suggested by the reviewer is a laboratory-based study which examines emotional and psychological responses to images of nature and public spaces before and during COVID-19 in 25 adults. Moreover, "Stay-at-home" orders varied to different degrees across countries, some of which did not discourage outdoor activity (and use of natural spaces) therefore we cannot generalize that "Stay-at-home" orders reduced exposure to greenery.

5. Under the discussion, the authors found that "having children, have been associated with higher anxiety during COVID-19." Please compare with other study that found having grown up children was significantly associated with lower levels of anxiety (Tee et al 2020): Tee ML et al Psychological impact of COVID-19 pandemic in the Philippines. *J Affect Disord.* 2020 Dec 1;277:379-391. doi: 10.1016/j.jad.2020.08.043. Epub 2020 Aug 24. PMID: 32861839; PMCID: PMC7444468.

We have included the following sentence but cited another of the reviewer's previously recommended papers (i.e., Wang, C., et al. (2021). "The impact of COVID-19 pandemic on physical and mental health of Asians: A study of seven middle-income countries in Asia." PLOS ONE 16(2): e0246824).

Page 9, paragraph 4: "Congruent with our findings, cohabitating, having children, and have lower of income have been associated with higher anxiety during COVID-19 in European studies^{49, 50} however, in Asian countries having no children at home, being single or separated, having higher education, and being younger adult (<30 years) has been associated with adverse mental health during COVID-19.^{15"}

6. The authors stated "Unlike other studies⁴⁶, we did not find higher anxiety among older adults which might reflect our potentially healthier sample" The following study found that students and young people were more anxious than older adults. Please discuss their findings: Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. *Int J Environ Res Public Health*. 2020 Mar 6;17(5):1729. doi: 10.3390/ijerph17051729. PMID: 32155789; PMCID: PMC7084952.

We have corrected this sentence and cited (Wang, C., et al. (2021). "The impact of COVID-19 pandemic on physical and mental health of Asians: A study of seven middle-income countries in Asia." PLOS ONE 16(2): e0246824) as this reference has recently been cited in the manuscript and the findings are more generalizable.

Page 10, paragraph 1: "We did not find higher anxiety among older adults which might reflect our potentially healthier sample. Notably, the effects of age on anxiety during COVID-19 reported elsewhere appears to be mixed.^{15, 50"}

7. The authors should discuss how to increase exercise level. One approach is cognitive behavior therapy. The behavior therapy can increase the exercise level. Please discuss the following: Use of Cognitive Behavior Therapy (CBT) to treat psychiatric symptoms during COVID-19 based on the following reference: Mental Health Strategies to Combat the Psychological Impact of COVID-19 Beyond Paranoia and Panic. *Ann Acad Med Singapore*. 2020;49(3):155-160

We agree with the reviewer that CBT is a potentially beneficial intervention for improving mental health and addressing psychiatric problems however, our paper focused on the link between anxiety and physical activity during the COVID-19 pandemic. CBT would be one of many approaches for either improving anxiety, physical activity, or both. While the benefits of individual-level approaches (like CBT) should not be discounted, our findings point to the need for strategies that can have a population health impact and the need to encourage physical activity in the context of pandemics when the number of opportunities for physical activity may be constrained due to the public health measures. In our manuscript, we have not been prescriptive in terms of how exercise levels can be increased but rather we direct the reader to sources that have comprehensively addressed this issue (see: Ding D, et al. Physical activity guidelines 2020: comprehensive and inclusive recommendations to activate populations. *The Lancet*. 2020;396(10265):1780-2; Hammami A, et al. Physical activity and coronavirus disease 2019 (COVID-19): specific recommendations for home-based physical training. *Managing Sport and Leisure*. 2020:1-6, and; Chtourou H, et al. Staying Physically Active During the Quarantine and Self-Isolation Period for Controlling and Mitigating the

8. One limitation is the cross-sectional nature of this study. Please refer to the following longitudinal study and comment on the change of stay home time and this will indicate the impact on physical exercise: A Longitudinal Study on the Mental Health of General Population during the COVID-19 Epidemic in China [published online ahead of print, 2020 Apr 13]. *Brain Behav Immun*. 2020; S0889-1591(20)30511-0. doi:10.1016/j.bbi.2020.04.028

We are not sure how describing the findings of the suggested paper mentioned above adds to the interpretation of our manuscript being limited because it is cross-sectional. The reviewer, who is a co-author on the paper suggested, mentions “The general population sampled during the two surveys were not the same respondents. Although the anonymity of the questionnaire made this sampling unavoidable, 333 respondents completed both the first and second surveys.” Further the study does not use random sampling for their two surveys and in fact uses snow-ball sampling implying that the two surveys are not comparable. The analysis presented in their paper is “cross-sectional” as the analysis are conducted separately for survey 1 and survey 2 data. We are not clear as to how adding the paper suggested by the reviewer adds clarity or strengthens our manuscript.

VERSION 2 – REVIEW

REVIEWER	Roger C. M. Ho Natl Univ Singapore, Psychological Medicine
REVIEW RETURNED	17-Jul-2021
GENERAL COMMENTS	I recommend publication.